DOCUMENT RESUME

ED 379 145 SE 054 714

TITLE	Mathematics Feedback 2. 5-14 Links.
INSTITUTION	Scottish Council for Research in Education, Edinburgh.
SPONS AGENCY	Scottish Office Education Dept., Edinburgh.
REPORT NO	ISBN-0-7480-0826-8
PUB DATE	93
NOTE	40p.
PUB TYPE	Guides - Classroom Use - Teaching Guides (For Teacher) (052)
EDRS PRICE	MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS	Elementary School Curriculum; *Elementary School Students; Elementary Secondary Education; Foreign Countries; Geometry; *Mathematics Achievement; *Mathematics Curriculum; *Mathematics Instruction; *Mathematics Tests; Measurement; Monetary Systems; Number Systems; Secondary School Curriculum; *Secondary School Students; Statistics
IDENTIFIERS	Scotland

ABSTRACT

This booklet describes information for teachers based on the findings of the third Assessment of Achievement Programme (AAP), a major research program funded by the Scottish Office Education Department. The AAP contained written tasks used with (n=7,648) pupils at three levels: primary 4 (P4), primary 7 (P7), and secondary 2 (S2). This booklet is organized according to the outcomes and strands of the national curriculum guidelines, Mathematics 5-14: number, money, and measurement; shape, position and movement, and information handling. Each section contains results and teaching issues related to the topic of the section, and a summary of these issues is included at the end of the document. Results include: P7 and S2 pupils were not as accurate in applications involving weight and volume as they were in working with money; S2 students had difficulties working with negative numbers; S2 students did not fully understand the relations between fractions, decimals, and percentages. Teaching and learning issues include: (1) Are a variety of methods used?; (2) What facts must be known before learning new topics?; (3) Is flexibility in methods of calculation encouraged?; (4) Can calculators be used as aids to learning; and (5) How can computers enhance the learning process? (MKR)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED 379 145

links

MATHEMATICS

Feedback

2

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☑ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL IN OTHER THAN PAPER COPY HAS BEEN GRANTED BY

R WAKE

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)"

1 £1 3/4

SE 054 714

BEST COPY AVAILABLE 2

Information for teachers – from the Assessment of Achievement Programme

AAP

WHAT IS *FEEDBACK*?

Feedback is an information resource for teachers, based around the findings of the Assessment of Achievement Programme (AAP), a major research programme funded by the Scottish Office Education Department. The first issue of *Feedback* looked at pupils' performance in mathematics and subsequent issues have focused on the other two main areas of AAP research — English language and science.

In a new series, *Feedback* 2 returns to the topic of mathematics, to look at the findings of the latest survey.

Feedback 2 can be used:

- As a source of information about the achievement of pupils in mathematics.
- When reflecting on achievement in your classroom.
- When reviewing teaching plans in relation to 5–14 attainment targets.
- When considering effective teaching strategies in mathematics.
- When assessing class work and reviewing performance in areas of the mathematics curriculum.
- When preparing assessment materials.
- As a stimulus for discussion at staff meetings or in-service days.
- With student teachers as part of their professional training and as an aid to classroom preparation.

Copyright © SOED 1993
ISBN 0 7480 0826 8

***Feedback* 2 may be photocopied for your own use.**

CONTENTS

	page
Introduction	
The third AAP mathematics survey	1
Structure of *Feedback 2*	2
How to use *Feedback 2*	2
Good news is no news?	3
Number, money and measurement	
Range and type of numbers	4
Add and subtract/Multiply and divide	6
Round numbers	8
Measure and estimate	10
Fractions, percentages and ratio	12
Perimeter, formulae, scale	16
Time	18
Patterns and sequences/Functions and equations	20
Shape, position and movement	
Range of shapes/Symmetry	22
Position and movement/Angle	24
Information handling	
Collect/Organise/Display	26
Interpret	28
Teaching and learning issues: a summary	30
Further reading	33
AAP publications	34

The third AAP mathematics survey

The third Assessment of Achievement Programme (AAP) survey of pupils' attainment in mathematics was carried out in 1991 by researchers at the Faculty of Education, Jordanhill Campus, University of Strathclyde. As in other AAP surveys, the assessment tasks were used with samples of pupils, selected to be representative of all pupils in Scotland, at three stages: primary 4, primary 7 and secondary 2.

The assessment framework for 1991 was a new one, which took into account the outcomes and strands of the Scottish Office Education Department's curriculum guidelines for five to 14 year olds. The assessments covered work with basic concepts and processes, and applications of these in a variety of familiar contexts, including simple problem solving tasks. To help teachers who are presently implementing the national guidelines, *Feedback 2* is organised according to the outcomes and strands of the guidelines, *Mathematics 5–14*, published in 1991.

For the first time in a national survey of mathematics, some tasks were grouped round themes or contexts, some based around illustrated booklets. Concepts, knowledge and skills were assessed by both written and practical tasks. The written tasks were done by 7648 pupils in 263 schools and the practical assessment by more than half the schools and pupils. The attainment levels of the 5–14 guidelines were used to guide the balance of the various tasks set at each stage. For example, the majority of tasks set at P4 were considered appropriate for at pupils working within level B, those set at P7 for pupils working within level D, and those set at S2 for those working within levels D and E. However, easier tasks were included at all stages for those working at lower levels and some harder tasks were included to allow the most able pupils to show what they could do.

Structure of *Feedback 2*

Feedback 2 is divide into three main sections which correspond to the 5–14 outcomes:

- Number, money and measurement
- Shape, position and movement
- Information handling.

To illustrate how performance in the AAP relates to the 5-14 curriculum, the sections of *Feedback 2* are grouped according to 5–14 strands, and each section contains brief extracts from the relevant 5–14 targets.

The text of *Feedback 2* is in the form of a 'quiz':

1. On the left hand page, are examples of the actual tasks given to pupils in the national survey.
2. Associated with each example are questions about the performance of pupils for you to answer.
3. Opposite, are the answers, which show what percentage pupils were successful on the tasks or what errors pupils commonly made.
4. There are also extracts from targets in the 5–14 guidelines which are relevant to the tasks illustrated.
5. Finally, there is a mention of some key teaching issues raised by the findings which are of practical relevance to teachers. You will be able to think of others.

On page 30 of *Feedback 2* there is a overall summary of some of the teaching and learning issues raised.

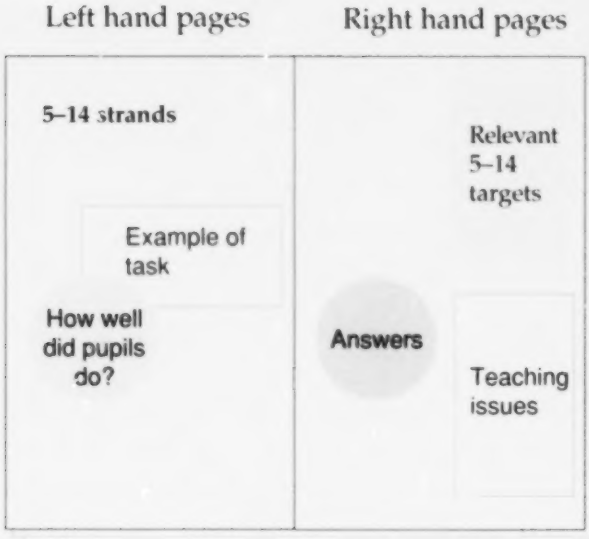
How to use *Feedback 2*

- **For individual study:**

Cover up the right hand page and study the tasks and questions on the left hand side. These invite you to use your experience to estimate the levels of achievement of pupils in the 1991 survey and to reflect on how you own pupils compare with a national sample.

- **For group discussions or inservice days:**

Make up handouts or overheads from the left hand pages and use the quiz to get the group talking about pupils' performance. This can follow on to discussions about teaching and learning issues.



Good news is no news?

Inevitably, to illustrate teaching issues of practical value to teachers, many of the examples chosen are those in which performance was poor or where the pattern of errors is of interest. In many tasks the performance of pupils was satisfactory or good. For a more comprehensive picture of performance readers should consult the fuller report of the findings published by HMSO (see page 33 for details).

5–14 strand:
RANGE AND TYPE OF NUMBERS

Ken is the baby kangaroo. He is standing two and a half metres from his mother.
Write two and a half metres in metres and centimetres
___ metres ___ centimetres

73% of P7 pupils were correct on this task.
What % of P4 pupils do you think were correct?

S2 pupils were much better than P7 on this task.
True or false?

Complete 3.4 m = ☐ m ☐ cm

Complete the following:
6.58 litres = 6 litres____millilitres

Were more than half of S2 pupils correct?

The children go for a space walk

Which incorrect answer was chosen by one third of P7 pupils?

Ann is 14m away from the space ship.
Asif is 1.05 m away.
Steven is 1.4 m away.
Kim is 10.5 m away.
Who is nearest the space ship?

S

5–14 targets:

Level B: Use the abbreviations m, cm and equivalences.

Level D: Work with: decimals to 2 places and equivalences among these in applications in money and measurement.

25%.

18% answered 2m $\frac{1}{2}$ cm.

False.
30% of P7 pupils and 36% of S2 were correct.

(36% of P7 and 28% of S2 wrote 3m 4 cm).

No, only 17% were correct.

Steven, 1.4 m.

(50% were correct with Asif, 1.05m).

TEACHING ISSUES

- To improve performance on equivalence of units of length, weight and volume, should pupils be given more practical work, or more practice through written work?
- Is there sufficient consolidation of the concept of place value at early stages?

5–14 strands:
ADD AND SUBTRACT
MULTIPLY AND DIVIDE

(a) Subtract 5.39 – 2.78 _____
(b) Subtract 500 – 256.3 _____

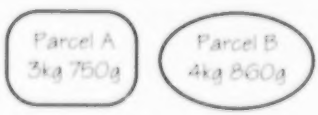
81% of S2 pupils were correct for task (a). What % for task (b)?

What % of pupils were correct at P7 and S2?

	%P7	%S2
(a)		
(b)		
(c)		

(a) Multiply 35.2 x 100
(b) Divide 749.3 ÷ 10
(c) Divide 936.7 ÷ 100

(a)



What is the total weight of parcels A and B ?
Answer ___ kg ___ g

(b) A ◄— 2 km 280m —► B ◄— 3km 850m —► C

What is the total distance from A to C?
Answer ___ km ___ m

Did P7 pupils do better on task (a) or (b)? What about S2 pupils?

52% of P7 pupils were correct. What were the two most common errors?

(part of a longer task)
The three bedrooms are to be painted white.
Brian's bedroom will use 1.75 litres.
Karen's bedroom will use 2.5 litres.
Mum and Dad's bedroom will use 2.75 litres.
How much paint is needed altogether?
_____ litres

How many bottles, each containing 0.7 litres, can be filled from a container holding 28 litres?
Answer _____bottles

What % of S2 pupils gave the answer 4?

5–14 targets:

Level D: Add and subtract without a calculator, for 4 digits with at most two decimal places.

Multiply and divide without a calculator, for 4 digits with at most two decimal places by a single digit.

Level E: Add and subtract without a calculator for 4 digits with at most 2 decimal places.

Multiply and divide without a calculator, for 4 digits with at most two decimal places by a single digit.

...in applications in number, measurement and money.

46%.

P7 pupils also achieved 81% correct for (a).

	%P7	%S2
(a)	38	54
(b)	41	61
(c)	35	50

Task (a): 55% of P7 pupils correct; 46% for (b).

74% of S2 pupils correct on (a); 62% on (b).

TEACHING ISSUES

- Do P7 pupils have enough experience of using sets of numbers with different numbers of digits (before and after the decimal point)?

12% of pupils gave 6.55 litres and 10% 4.75 litres.

- Is more practical work required to improve performance on exchange of units? What is the correct balance of time to be spent on the various aspects of measure?

21%.

(37% were correct with 40).

- Should we be putting more emphasis on teaching written algorithms or allowing more use of the calculator for tasks set in real life contexts?

BEST COPY AVAILABLE

5–14 strand:
ROUND NUMBERS

Sima has collected 18 shells to decorate the castle.
Round 18 to the nearest 10
_____

By what stage were 49% of pupils correct: P4, P7 or S2?

Many more pupils at S2 were correct than at P7. True or false?

Which of the numbers below is the best approximation to 48 x 53?
Underline your answer.
2000 2024 2500 3000

The value of 0.2016 × 0.4116 is approximately:
A. 8.0
B. 0.8
C. 0.08
D. 0.008
E. 0.0008
Ring your answer: A B C D E

23% of S2 pupils were correct. The most common wrong answer was B. True or false?

What % of S2 pupils were correct?

(part of a longer question)
Converted to metric units the load is approximately 5090.9 kg
What is the total load of the lorry to the nearest 100 kg?
_____kg

(practical calculator task)
231 pupils are going on a trip.
One bus holds 55 passengers.
How many buses are needed?
_____buses needed

10% of P4 pupils rounded up correctly (5 buses). What % of P7 and S2 pupils were also correct?

5–14 targets:

Level B: Round 2 digit whole numbers to the nearest 10.

Level D: Round any number to the nearest appropriate whole number, 10 or 100.

Level E: Round any number to one decimal place.

By P4.

False.

About 60% of pupils were correct at both stages.

False.

Many pupils appeared to be guessing.

43% of S2.

45% and 65% respectively.

At P7, 12% gave 4.2 or 4R2 and 7% 42. At S2, 18% rounded down to 4, 8% gave 4.2 and 3% 42.

TEACHING ISSUES

- Performance at all stages in using the calculator was excellent. Should there be less emphasis on estimates by rounding and more emphasis on calculator checks?
- Should pupils be encouraged more often to estimate from experience, in familiar contexts — to check that their answers are reasonable? Is this particularly important for less able pupils?
- Should all pupils at S2 be expected to make close estimates, rounding up or down appropriately?

5–14 strand:
MEASURE AND ESTIMATE

(practical task with metre stick, Post-pak box, 47 cm in length and 1m 24 cm of gift ribbon.)
A present has arrived in the post.

Measure the length of the box.
Task 1. Write your measurement here

_____

Tina untied the ribbon from the present inside the box.
Measure the length of the piece of ribbon.
Task 2. Write your measurement here

_____

(pupils were marked correct for measurement ± 1 cm for task 1 and ± 4 cm for task 2.)

S2 pupils did much better than P7 on both tasks. True or false?

5–14 strand:
MONEY

By what stage were over 80% of pupils correct: P4, P7 or S2?

(practical task)
Pupils were given a selection of coins and asked to give the change from:
(a) £1 for a purchase of 87p
(b) £5 for a purchase of £1.87.

5–14 targets:

Level B: Measure in easily handled standard units and fractions of them: length m 1/2m, 1/4m, cm.

Use the abbreviations m, cm and equivalences.

False.

% correct were:

	P4	P7	S2
Task 1	38	66	66
Task 2	37	69	56

At S2 9% of pupils gave no units and 10% wrong units on task 1 (At P7: 10% and 2%; at P4: 23% and 3%).

TEACHING ISSUES

• Are pupils getting sufficient practice in making accurate measurement? Is this a concern for secondary teachers of mathematics or of science? Or both?

5–14 targets:

Level B: Use coins up to £1 including exchange (50p = 5 x 10p).

Level C: Use coins/notes to £5 worth or more, including exchange.

By S2.

% correct were:

	P4	P7	S2
Task (a)	50	87	91
Task (b)	22	72	81

TEACHING ISSUES

• Pupils were more competent on practical tasks with money than with decimal number tasks. Does this have any implications for the teaching of place value?

BEST COPY AVAILABLE

5–14 strand:
FRACTIONS, PERCENTAGES AND RATIO

Each of the 16 girls in Alison's class chooses a drink for a packed lunch.

$\frac{1}{4}$ of the 16 girls choose orange juice.
How many orange juices are needed?
_____ orange juices

What % of P4 pupils do you estimate were correct?

$\frac{2}{3}$ of the 12 children go to the same school as Tom.
How many children is this?
_____ children

More than 70% of P7 pupils were correct.
True or false?

What % of P7 pupils were correct on (a) and (b)?

(a) Add $\frac{2}{8} + \frac{3}{8}$

Answer _____

(b) Add $\frac{3}{8} + \frac{1}{4} =$

Multiply $\frac{3}{8} \times \frac{2}{3} =$ _____
(Give your answer in the simplest form.)

What % of S2 pupils gave a fully correct answer?

What % of S2 pupils were correct:
14%, 34%, 54%?

Express the fraction in its simplest form
$\frac{280}{120}$

5–14 targets:

Level B: Find halves and quarters of quantities involving 1 or 2 digit numbers.

Level C: Find simple fractions (1/3, 1/5, 1/10) of quantities involving 1 or 2 digit numbers.

Level D: Find simple fractions (1/7, 3/4, 3/5, 60/100) of quantities involving at most 4 digits (easy examples).

Level E: Mentally find widely-used fractions.. of whole number quantities.

Level E+: Understand and use equivalence of fractions.

42%.

False.

58% were correct (Also: 72% of S2 pupils were correct).

73% for (a) and 34% for (b).

In (a) 15% gave $\frac{5}{16}$.

In (b) 30% gave $\frac{4}{12}$.

34%.

(a further 8% did not give the answer in its simplest form).

14%.

TEACHING ISSUES

- What contexts would make operations with fractions more relevant to pupils' needs and prior experience?
- Would more emphasis on cancelling or reducing fractions to the simplest form be helpful in improving performance in estimation?
- Should more emphasis be placed on fractions at early stages to prepare the ground for teaching percentages and algebra at later stages?

5–14 strand:
FRACTIONS, **PERCENTAGES** AND RATIO

In a test a boy scored 32 out of 50.
Write his results as a percentage.
Answer ____ %

By what stage were 44% of pupils correct: P4, P7 or S2?

54% of S2 pupils were correct. What % were correct at P7?

The total entrance charge for the school party should be £500 but the school is given a 10% discount.
How much does the school pay?
Answer £____

In one week the fish eaten by 4 sealions is:
120 kg herrings
60 kg whiting
20 kg sprat.
What percentage of the fish eaten is made up of herrings?
____ %

30% of P7 pupils were correct. What % were correct at S2?

Several different shops have offers on toothpaste.

Just over a half of S2 pupils were correct. True or false?

The recommended price is £1.25.
The Corner shop offers:
20% off recommended price
What is the price in the corner shop?
____

5–14 targets:

Level D: Work with: fractions and percentages.

Level E: Mentally find widely used...percentages of whole number quantities.

By S2.

31% were correct at P7.

39%.

44%.

False.

33% of pupils were correct.

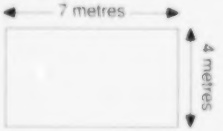
TEACHING ISSUES

• Is apparent lack of conceptual understanding in percentages an area of concern for teachers? What teaching approaches could be used to deal with this?

5–14 strands:
FRACTIONS, PERCENTAGES AND RATIO
PERIMETER, FORMULAE, SCALE

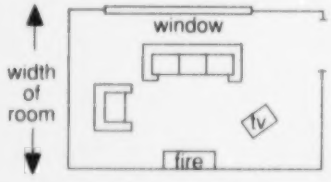
50% of P4 pupils were correct on this task.
What % of P7 and S2 pupils ?

Calculate the perimeter of the rectangle.



Answer ____ metres

To help the family decide where to arrange the furniture in the living room they make a scale drawing.
The scale is 1 cm to 50 cm.



The width of the room on the plan is 6 cm.
(a) What is the actual width?_____ cm

The table is 1 metre 75 cm in length.
(b) On the plan what length will it be?
_____ cm

52% of P7 pupils and 75% of S2 were correct on task (a).
What % of pupils were correct on (b)?

31% of P7 pupils were correct on task (a).
What % of S2 pupils were correct on (b)?

(a) The ratio of boys to girls in a class is 3:2.If there are 15 boys how many girls are there?
Answer _____ girls

(b) In a group of 160 people the ratio of women to men is 3:5.How many women are in the group?
Answer _____

5–14 targets:

Level D: Calculate perimeter of simple straight sided shapes by adding lengths

Level E: Use scales such as 1 cm to 1, 2, 5, or 10m or represented by a ratio such as 1:100...

Find ratios between quantities.

Use simple unitary ratio.

42% (P7) and 60% (S2).

Most common error at P4 was adding 7 + 4 (10% of pupils) and, at P7 and S2, confusing perimeter and area (43% and 28% of pupils).

17% (P7) and 32% (S2).

25%.

TEACHING ISSUES

- Would more practical work on such aspects as scale drawing help to improve performance?
- Should the introduction of any of these concepts be delayed or is more direct teaching required?

5–14 strand: TIME

What % of P7 and S2 pupils assumed 100 mins to the hour rather than 60 mins?

A postman works 6 days in the week. He takes 2 hours 50 minutes each day to deliver his letters.
How much time does he spend delivering his letters each week?
Answer ___hours___minutes

(a) What is the average speed of a bus which can travel 30 km in 1 $\frac{1}{2}$ hours?

_____km per hour

(b) A car travels for 4 hours at an average speed of 60 kilometres per hour. How far has it travelled?
Answer_____km

What % of pupils at S2 were correct on task (a)? and on (b)?

Which task did S2 pupils do better: (a) or (b)?

(part of a longer question)
(a) Later in the week, Jim decides to record the film which starts at 7.55 pm and ends at 9.15 pm. How many minutes of videotape are needed?

(b) Subtract 7 hrs 55 min from 9 hr 15 min
Answer ___hours(s)___minutes

5–14 targets:

Level D: Use 24-hour times and equate with 12-hour times.

Calculate duration in hours/minutes, mentally if possible.

Level E+: Work with calculations and graphical representaiton involving time, distance and speed.

46% (P7) and 39% (S2).

% correct were: 12% (P7) and 21% (S2)

40% (a) and 77% (b).

Also: 20% of P7 pupils correct on (a).

(a).
49% of S2 pupils correct.
(12% gave 120 min; 8% gave 160 min)

On task (b) 34% were correct.
(16% gave 1 hr 60 min; 12% gave 2 hr 40 min and 11% 2 hr 0 min)

TEACHING ISSUES

- In working with time, should methods of decomposition be avoided as far as possible in favour of 'adding on'?
- Are more difficult topics, such as average speed, taught at appropriate times in programmes of work? Which should be taught first — using average speed (a concept that has not been fully mastered) — or calculating average speed?

BEST COPY AVAILABLE

5–14 strands:
PATTERNS AND SEQUENCES
FUNCTIONS AND EQUATIONS

(a) Complete
□ ÷ 4 = 3

(b) Complete
8 x □ = 40

P4 pupils found task (b) much more difficult than (a).
True or false?

What is the value of $2b^2$ when b = 7?
Answer _____

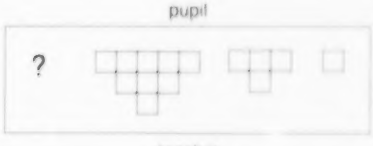
What % of S2 pupils were correct?

(a) Solve for x
x + 8 = 17
Answer _____

(b) Solve for x
3x + 7 = 16
Answer _____

94% of S2 pupils were correct on task (a). What % could do (b)?

(practical task)
Pupils were asked, 'Can you describe the next pattern of tiles in the sequence:'



Pupils rearranged the tiles in squares 'so that they are easy to count'. After checking that the pupil realised that the sequence was: 1, 4, 9, 16, the assessor asked, 'What is special about the four numbers in this sequence?'

Fewer than half of S2 pupils could do both parts of this practical task.
True or false?

5-14 targets:

Level B: Find the missing numbers in statements where symbols are used for unknown numbers or operators.

Level D: Recognise and explain simple relationships between two sets of numbers or objects.

Level E: Solve simple equations and inequations.

Use and devise simple rules.

Continue and describe sequences involving square and triangular numbers.

Level E+: Be able to use confidently expressions such as: $...2n^2$.

False.

41% were correct for (a) and 74% for (b). The format proved more important than the relevant number facts.

15%.

58%.

True.

69% described the correct pattern, but only 37% recognised the sequence of square numbers.

TEACHING ISSUES

- Could able pupils be stretched in this work by more teacher intervention rather than by pupil-centred individualised learning?
- At what stage is it appropriate to expect pupils to use algebraic notation? Can we improve pupils' ability in this area by encouraging them to express generality in words before they attempt to use formal notation?

5–14 strands:

RANGE OF SHAPES SYMMETRY

(practical task)
Pupils at all stages were asked to name solid wooden shapes and count the number of faces on each.

Which shape gave the greatest difficulty to P4 in: (a) naming; (b) counting the faces?

Draw a line of symmetry on each road sign.

What % of P7 pupils were correct on both signs?

Draw the lines of symmetry in the following rectangle.

What % of S2 pupils drew the diagonals as lines of symmetry?

In which of the following shapes must the diagonals be equal in length?
A. Parallelogram
B. Rhombus
C. Rectangle
D. Kite
Ring your answer.
A B C D

At what stage were 28% of pupils correct?

Different shapes are used to construct a variety of cardboard boxes.

To make the first shape (a regular triangular prism) this net is cut out and folded up.

Draw a possible net for a cube.
Draw a possible net for a square-based pyramid.

S2 pupils had less difficulty with the net of a square-based pyramid than with the net of a cube. True or false?

5–14 targets:

Level A: Identify and name cubes, cuboids, cones, cylinders and spheres.

Level B: Identify and name...square pyramid.

Level D: Make 3D models, solid or skeletal, including using nets: cube and cuboid only.

Identify and draw lines of symmetry, generally up to 4.

Level E: Make 3D models, solid or skeletal, including using nets: triangular prism, pyramid.

(a) pyramid (18% correct).

(b) cylinder (12% correct).

82%.

28%.

(55% drew the correct lines).

At S2.

True.

84% correct for pyramid and 78% for cube. (68% of P7 could draw the net of a cube).

TEACHING ISSUES

- Which aspects of properties of geometric shapes need more emphasis — and which less emphasis?
- What type of practical work would help improve performance in the weaker areas?

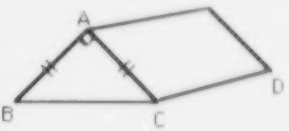
5–14 strands:
POSITION AND MOVEMENT
ANGLE

In each circle draw another straight line from the centre C to complete a right angle. One is done for you.

What % of P4 pupils were correct?

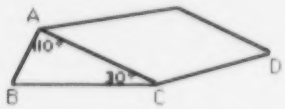
A garage is built in the shape of a cuboid.

The roof can be flat as shown above or shaped in different ways as shown below.
In roof shape 1, AB = AC.



The size of angle ABC is
_____°

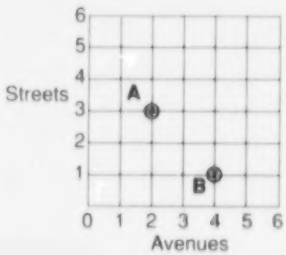
In roof shape 2, angle BAC is 110° and angle BCA is 30°.



The size of angle ABC is
_____°

44% of S2 pupils were correct for roof shape 2. What % were correct for roof shape 1?

Some towns like New York have parallel streets crossing avenues at right angles.
Mark C (3,5) on the grid.



Performance of P7 and S2 pupils was similar. True or false?

5–14 targets:

Level B: Give and understand instructions for turning through angles.

Use a template to draw or check for a right angle.

Level D: Use a co-ordinate system to locate a point on a grid.

Level E: Know the sum of the angles of a triangle is two right angles.

Level E+: [Use Pythagoras' theorem to be able to] Divide a shape into right angled triangles which can be worked on.

47% on both circles.

A further 8% were correct on one circle. (11% drew 60° angles.)

22%.

Two steps were necessary in part 1, only one step in part 2.

True.

79% of pupils were correct at P7 and 72% at S2.

TEACHING ISSUES

- Which aspects of position and angle need more emphasis — and which less emphasis?
- What part have computers to play in improving pupils' levels of achievement on position, movement and angle?

5–14 strands:
COLLECT
ORGANISE
DISPLAY

(practical task at P4 and P7)
Tom and Tina must find out whether they have enough cutlery for the birthday tea. Open the plastic bag and look inside.
Think of a name for each kind you find.
Two names have already been put in a table below. Write in the names which have been left out.

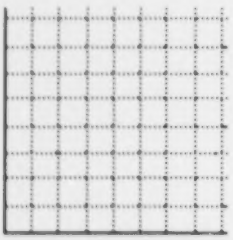
What % of P4 and P7 pupils collected and organised data correctly into a table?

cutlery	
knives	
large spoons	

Find out how many of each kind there are and complete the table.Now ask the teacher to check what you have done so far.

cutlery	number of pieces
knives	2
large spoons	3
small spoons	7
forks	1

Use the information in the table to make a graph. Draw it in the squares below. Ask the teacher for the help card if you don't know how to start.



When you are finished, mix up the cutlery and put it back in the bag.

11% of P4 and 48% of P7 pupils drew a fully correct bar chart without help.
What was the most common error?

5–14 targets:

Level A: By collecting information about themselves and familiar objects

Level B: By constructing a bar graph with axes graduated in units and with discrete categories of information

Level C: By entering data in a table using row and column headings.

Level D: From a range of displays and databases, by retrieving information subject to one condition.

73% (P4) and 3% (P7).

However, many did not put a heading on the table.

Failing to number the axis: 21% of P4 and 17% of P7 pupils.

TEACHING ISSUES

• Pupils performed well at many aspects of compiling simple tables and graphs. Is it important for pupils at these stages to master all the formal conventions of displaying data?

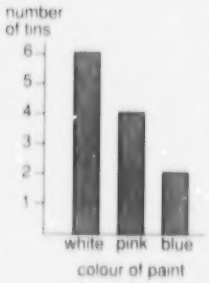
BEST COPY AVAILABLE

5–14 strand:
INTERPRET

INFORMATION HANDLING

What % of P4 pupils were correct on each part:
About 25%?
About 50%?
About 75%?

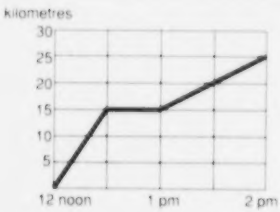
This is a bar chart showing the different colours of paint used.
How many tins of pink paint are needed?
_____ tins
How many tins of paint are needed altogether?
_____ tins



Car Park charges	
length of stay	cost
up to 1 hour	60p
up to 2 hours	£1.00
up to 4 hours	£2.00
over 4 hours	£4.00

A car enters a car park at 9.17 am and leaves at 1.04 pm.
How much does this stay cost?
_____

46% of P7 pupils were correct.
What was the most common wrong answer?



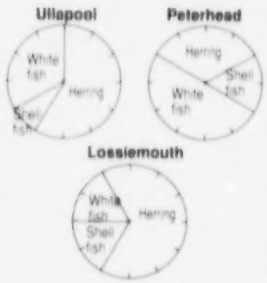
This graph shows how far a cyclist went and the time he took to get there.

(a) How many kilometres did he cycle altogether?_____ km
(b) How long did he stop during the journey?_____ minutes
(c) How far did he cycle in the last half-hour of the trip?_____ km

80% or more of S2 pupils were correct on each part.
True or false?

What % of P7 and S2 were correct on both (a) and (b)?

These charts show the fish landed at 3 Scottish Ports.
(a) In which port is 2/3 of the catch herring?
Answer_____
(b) In which port is 1/3 of the catch white fish?
Answer _____



5–14 targets:

Level C: For displays and databases: by retrieving specific records; by identifying the most and least frequent items.

Level E: From an extended range of displays (diagrams, tables, graphs, pie charts) retrieving information subject to more than one condition.

About 75%.

£4.00

(34% of pupils)

True.

	%P7	%S2
(a)	72	92
(b)	57	81
(c)	60	80

About 50% (P7) and just over two thirds (S2).

TEACHING ISSUES

- Pupils performed well when information could be read directly from a table or graph. Should more time be spent on more complex interpretation? Would computer graph drawing packages be useful for this purpose?
- Information handling offers a useful opportunity to consolidate areas of mathematics which give concern, for example percentages, subtraction of time, rounding of numbers. How can this best be achieved?

TEACHING AND LEARNING ISSUES: A SUMMARY

Planning programmes of work

- *Are topics taught at appropriate times in programmes of work and in a logical sequence?*

Calculation of average speed was found difficult at P7. Which should be taught first, using average speed (that is using a concept which has not been mastered) or calculating average speed?

- *Are programmes broad enough to cover all necessary content and well balanced so as to ensure sufficient coverage of important points?*

P7 and S2 pupils were not as accurate in applications involving weight and volume as they were in working with money. Do pupils get enough experience of applying concepts in weight and volume? What is the right balance of time to be spent on the various aspects of measure?

- *Do the programmes of work include sufficient opportunities for consolidation and revision?*

Only half of S2 pupils could name solid shapes such as pyramid and cylinder. Had pupils who had learned the names in primary school forgotten them because of lack of regular use of the names or of work with the shapes?

- *Are concepts, facts and techniques met and applied in a variety of contexts? Are the contexts sufficiently motivating and relevant to the pupils?*

S2 pupils had difficulties in working with negative numbers. Would putting the work in context help? What contexts would be motivating for 12–14 year olds? P7 pupils could add and subtract fractions only if they had a common denominator. Can work in operations with fractions be put in suitable contexts which would be relevant to pupils' needs and prior experience? How complicated should such operations be?

• *Are links between topics in mathematics and other curriculum areas made clear enough?*

S2 pupils did not fully understand the relations between fractions, decimals and percentages. Are the links between them stressed enough? Is the extent and nature of use of them in other curricular areas taken into account in mathematics classes?

• *Do the programmes include enough opportunities for pupils to apply the techniques they have learned and general process skills in solving problems? Are techniques and skills learned in problem-solving contexts?*

Pupils found difficulty in devising rules. Do they have enough experience of spotting patterns and generalising from them? Are they taught specific strategies for organising information and analysing sequences? At what stage is it appropriate to expect pupils to be able to learn to use algebraic notation? Can we improve pupils' ability in this area by encouraging them to express generality in words before they attempt to use formal notation?

Teaching and learning

• *Are a sufficient variety of methods used (exposition, discussion, enquiry, activity)? What topics are best suited to what approaches? Do different pupils respond better to some approaches than to others?*

Understanding of units of length, weight and volume was only slightly better at S2 than at P7. Do pupils get enough experience of practical tasks involving measurement? Should there be more exposition of facts and techniques in this area? Could pupils' performance be improved by a judicious mix of teaching approaches?
Performance in solving simple equations was variable. Is a "flags" approach, where the sequence of operations and the reverse sequence of inverse operations are considered, better than the standard approach to solving equations in which operations are done to each side of the equation?

- *What facts must be known, concepts acquired, techniques mastered before learning in a new topic can take place?*

Estimation of answers to calculations with decimals was not done well. Did pupils have the pre-requisite skills of rounding and mental calculation?

- *Is flexibility in methods of calculation encouraged and sufficiently well developed? Do pupils develop an understanding of the appropriateness of mental, written and calculator methods in different situations? Is enough emphasis put on alternative methods to the traditional algorithms for the four operations?*

P7 pupils had difficulties with calculation of time intervals. Were they attempting to use subtraction algorithms and finding difficulty in working in base 60? Did they appreciate that methods of 'counting on' are perfectly valid and possibly more appropriate in this case?

- *Can calculators be used as aids to learning?*

The concept of place value was not securely established in all pupils. Can pupils develop the concept by investigations and problems involving the use of the calculator (for example younger pupils could investigate how to remove the 5 from 2573 by one subtraction)?

- *Can practical materials and structured apparatus be used to help pupils to acquire concepts?*

P4 pupils had more difficulty in working with fractions of groups of objects than with recognising and shading simple fractions of circles and rectangles. Would practical work in sharing out objects have been appropriate at this stage? Could this type of work lay the foundation for developing understanding in multiplication and division?

- *How can the use of computers enhance the learning process?*

Would working with computer spreadsheets help pupils to develop understanding of patterns and sequences? How can graph-drawing packages be used to aid teaching and learning?

FURTHER READING

Scottish Office Education Department. *Assessment of Achievement Programme. Mathematics 1991*. Edinburgh: HMSO, 1993.
This gives fuller details of the findings and is available from HMSO Scotland bookshops, by post or by telephone, price £6.70.

Scottish Office Education Department. *Curriculum and Assessment in Scotland. National Guidelines. Mathematics 5–14*. Edinburgh: SOED, 1991.
This gives further details of the 5–14 curriculum guidelines in Scotland.

AAP PUBLICATIONS

Earlier editions in the *Feedback* series for teachers:

Mathematics at P4, P7 and S2 (one booklet for each stage)
Science at P4/P7 and P7/S2 (each leaflet covers two stage)
English Language (two booklets: *5–14 links* and *Assessment tasks*)
Science for primary and secondary (one booklet).

A number of reports have been published by HMSO, summarising the main findings of the AAP research teams:

Home Economics (1989)
Technical Education (1989)
English Language, 1st survey (1989)
Mathematics, 2nd survey (1989)
Science, 1st survey (1990)
English Language, 2nd survey (1990)
Science, 2nd survey (1992)
Mathematics, 3rd survey (1993)

The Assessment of Achievement Programme's own newsletter, *Noticeboard*, provides the latest news about the people and projects involved in the AAP. *Noticeboard* is sent free to schools throughout Scotland.

To obtain copies of any literature on the AAP or on other SOED research contact the SOED Dissemination Officer at the Scottish Council for Research in Education, 15 St John Street, Edinburgh, EH8 8JR.

THE SOED RESEARCH AND INTELLIGENCE UNIT

The Assessment of Achievement Programme is directed by the SOED Research and Intelligence Unit (RIU). The RIU is also responsible for:

- Planning and managing a wide ranging programme of research in education;
- Providing research based advice to ministers, the SOED and HM Inspectorate;
- Disseminating the results of research throughout the Scottish education system; and
- Encouraging and maintaining interest and expertise in educational research in schools, colleges, universities and research institutes.

Designed, edited and produced by
the Scottish Council for Research in Education for the Scottish Office Education Department.
Cover design by The Graphics Company.
Printed by Nevisprint Limited, Fort William

BEST COPY AVAILABLE